



## DECLARATION OF BRIAN P. ROARTY

I am the inventor of the invention described in patent application 10/797,255, "Implementation And Application Of Phase Change In A Fluid Flowing Through A Nozzle". I am also a co-inventor of U.S. Patent 7,442,287, titled "Material surface treatment method using concurrent electrical, vibrational and photonic stimulation".

All identified Exhibits mentioned herein are records derived from experiments I conducted and are expressly incorporated as part of my Declaration.

I and my colleague conducted several experiments which provide precisely that definitive data ruling out recombination as the source of the apparent "excess heat". First, as part of our experiments we monitored both the environmental surroundings and the experimentally-controlled heat inputs throughout each run. Neither the environmental temperature (from which the reaction vessel was insulated), nor the input heat source, could explain the observed, periodic, and significant heat peaks and post-experimental changes in the electrode. There was no evidence of any "recombination" as suggested by Shanahan; the fluid was non-reactive with the vessel. There was considerable evidence countering any such inference, as well, as described below:

First, Shanahan's suggestion of 'recombination' implies that once a ground state, in terms of temperature, pressure, other external stimuli, and materials is provided, such recombinations should occur either in a pattern that reflects the 'steady state' of the experiment, or that randomly varies throughout the observational period. In every run of our experiments, there was a minimal 'prelude period' which was a minimum of two hours, but only after that period and after stimulation started, did periodic 'heat spiking' begin to occur.

Second, Shanahan's suggestion of 'recombination' would require a chemical process. Pre- and post- analysis of the material of the electrode showed that the metal had, during the experiment, encountered such intense heat spikes as to deform. An example of such deformation, observed by Scanning Electron

Microscope, is shown in Exhibit 1. Specifically, observe the delamination at the base of the photograph (the separation shown in the dark band between the two lighter bands of palladium at the bottom third of the photograph).

Third, Shanahan's suggestion of 'recombination' and its basis (chemical transformation), fails to explain evident atomic transmutation detected after the experiment(s). The treated palladium electrodes (measured by a spectrographic assay with a 1% detection threshold) lacked any silver pre-experiment; but in the run of Dec. 28th, 2008, a post-run spectrographic assay disclosed the presence of silver at numerous sites.

A general description of the experiments and specific details which negate the theoretical objection and asserted 'recombination' explanation cited by the Office action follows.

#### *Basic Description of the Experimental Tests*

While enhancing the aforementioned ~287patent, testing moved from an open glass beaker into a sealed vessel to prevent the escape of steam and other things that might affect the reaction. It became much more practical to instrument each experiment and to data log the process and results, as one might expect; for providing a more-controlled environment and process, means providing an experiment that is also more measurable and more measured. What was surprising, was that the reaction proved to be more robust when taking place in such a sealed container with specific refinements described herein.

Firstly, measurement of energy input and output became loggable rather than merely observable through perception of changes (i.e. bubbling). Secondly, prevention of contamination from the outside environment was greatly increased, which highlights the internal-to-the-process nature of temporary, even if recurrent, in-experiment events.

As with the protocol described in U.S. Patent 7,442,287, each experiment involved a 'preparation phase'. A liquid medium incorporating electrolyte and surfactant elements in

solution such that the combination had a pH between 6.5 and 8.9, was placed into a container, which was then closed. At first this was 25 ml of liquid, but then this was raised to 30 ml. The liquid in the vessel was blanketed with a combination of hydrogen and helium, in approximately equal percentages. These gases were introduced through two inlet valves and the atmosphere vented through an outlet valve, replacing the standard atmospheric mixture of nitrogen/oxygen/miscellaneous gases, before the induction effort began.

In our early experiments, for a set period, two hours, the solution was maintained at or just below the boiling point ( $100^{\circ} - 101^{\circ} \text{C}$ ; in the preferred embodiment, this would be  $102^{\circ} \text{C} \pm 1^{\circ} \text{C}$  to ensure it remained below, but just below, boiling), at 1 bar pressure. Immersed in the solution were a pair of electrodes, surface treated with a gap between them. In later experiments, we accepted the transient heat spikes as evidence of the reaction and were less concerned about attaining a thermal equilibrium.

No heat spikes were observed during any run during this 'preparation phase' – yet at least one such should have been observed during this time if Shanahan's 'recombination' objection is valid. With the conditions for such recombination having been established and maintained for that period before the stimulation was applied, the limitation of the observation of heat spikes to the post-preparation period cannot be laid off to chance or experimental variation.

The vessel used was a stainless steel cylinder with a central well 2 inches deep and 2 inches in diameter, having a closed bottom and a removable top. Ultimately, it was dimensioned to accommodate a glass beaker capped with a quartz top. Holes in the top allowed electrodes and thermocouples to pass through it.

Four "ultrabright" white LEDs capable of generating 15,000 mcd were spaced equally around the vessel below the surface of the liquid as photonic stimuli. These stimuli were provided through sealed glass ports in the vessel wall. Electrical stimuli were provided via three palladium wires of .025" diameter: an anode for the RF stimulus, a second anode for the DC stimulus, and a common cathode. The electrodes formed a triangle with sides 0.9, 1.45, and 1.45 inches long. The shortest side lay between the RF

anode and the common cathode. The electrodes and the thermocouples were equally spaced on a bolt circle, so thermocouples would be 0.9 and 1.45 inches away from the cathode.

All three electrodes were isolated from the vessel and sheathed in glass tubing to the surface of the liquid in order to keep them straight and to concentrate the RF stimulus in the liquid. The electrodes passed through the vessel's top via Teflon<sup>®</sup> seals compressed with Swagelok<sup>®</sup> fittings.

Thermocouples were used to monitor the temperature of the liquid via thermocouple wells projecting into the liquid. The wells were first made of stainless steel and later of glass. The thermocouples also passed through the vessel's cap via Teflon<sup>®</sup> seals compressed with Swagelok<sup>®</sup> fittings.

A heating coil was located in a cavity in the bottom of the vessel, and its input voltage and current measured to monitor input power.

#### Stimulation – Experimental Phase

After the temperature of the liquid had remained stable within the above-described range over a couple of hours, photonic and RF stimuli were applied in manner similar to the one described in the U.S. Patent 7,442,287.

Two fundamental observations obviate, for invention's method and apparatus, any explanation offered by inter-molecular (chemical) theory. First, pre- and post- protocol observations confirmed transmutation occurred. Secondly, in-process measurements, and pre- and post- process comparisons of the experimental equipment, show irrefutable evidence of exothermic reaction; intense, repeated, bursts of heat occurred within the experimental vessel. The data logs showing those bursts of heat were made with an Agilent 34970A, and the data logs provided with this declaration were printed from that instrument's companion software package . That software uses a proprietary data base, such that the stored data cannot be modified by the user.

### Observation One: Transmutation

One of the differences in the set of experiments that led to this invention was the confirmed, repeated, and multiple evidences of transmutation during the process; most notably, of palladium to silver ( $_{46}\text{Pd} \rightarrow _{47}\text{Ag}$ ), the expected result when a neutron in the palladium nucleus converts to a proton, which occurred during the course and as a consequence of these experiments. Additionally, transmutation products of elements other than palladium were detected in several experiments. For example, in the experiment run on Feb. 28, 2009, tests were run using a Scanning Electron Microscope (SEM) that detected, fluorine was detected at four sites – and no fluorine had been knowingly either present or introduced.  $_9\text{F}$ , however, would be the transmutation product of  $_8\text{O}$ , which had been present.

Pre- and post-experimental observation, plus the fact that the beaker was closed, eliminated the possibility of accidental contamination with the observed different elements. Two different techniques, EDS and Auger analysis, were used to evaluate the presence/absence of elements. The measurement of elemental distribution was made with a coarse degree of precision; an element was only identified as present when it was detectable at more than a 1% concentration of the sample. There may have been more transmutation products, but elements which did not constitute at least 1% of the final sample, would presumably not have been detected since they did not rise above the detection threshold of the analytical method.

Exhibit 2 is the Atomic Concentration Table from the Auger analysis of the January 3, 2009, experiment. Note the post-protocol presence of nitrogen, aluminum, chlorine, and copper. None of these had been present in the pre-stimulus condition (remember, the ordinary atmosphere, which includes nitrogen, had been replaced with a hydrogen/helium mix). Each of these is a transmutation product of one of the ingredients in the protocol: specifically:

- $_6\text{C}$  transmutes into  $_7\text{N}$ ;
- $_{12}\text{Mg}$  transmutes into  $_{13}\text{Al}$ ;
- $_{16}\text{S}$  transmutes into  $_{17}\text{Cl}$ ; and,
- $_{29}\text{Cu}$  transmutes into  $_{30}\text{Zn}$ .

Further, the  ${}^9\text{F}$  found above in the Energy Dispersive X-ray Spectroscopy (EDS) analyses is explainable by this protocol as the transmutation product of  ${}^8\text{O}$  which was present in the pre-experiment environment, while fluorine was not.

There may well have been considerable other transmutation, particularly of the lightest elements; if hydrogen or lithium had transmuted to helium and beryllium (respectively), they would not have been detected by EDS, which does not detect elements with atomic numbers below five.

The presence of gallium in the one sample cannot be accounted for by a single-step transmutation; it was not knowingly introduced or present in the pre-experiment state, but could be a second one-proton shift transmuted  ${}_{30}\text{Zn}$  to  ${}_{31}\text{Ga}$ .

Strong, even irrefutable, evidence of transmutation products of six different elements using two different analytic techniques, EDS and Auger analysis, with aluminum having been found with both of them, creates an overwhelming presumption of nuclear – intra-atomic – effect. Taken together, the data supports a strong claim that this protocol has induced nuclear reactions on numerous occasions.

Any transmutation provides clear and irrefutable evidence that of a reaction which is nuclear in nature; molecular chemistry is incapable of changing one element into another. Heretofore, artificial nuclear transmutation has been believed to be induced only at either very high temperatures such as those found in plasmas or with high-energy stimuli. This protocol operates at or near the boiling point of water and under normal or near-normal (1 bar) atmospheric pressure. At no time during the protocol did the applied energy input exceed fifty Watts, with the great majority of that energy being heat used to elevate the temperature of the reaction near or to the boiling point. The electrical and/or photonic stimuli provided less than 100 milliwatts. Thus, the experimental evidence confirms the existence of low energy nuclear reactions (LENRs).

### Observation Two: Exothermic Heat Pulses

The second observation, or set of observations, reveal the presence of exothermic reactions in the vessel. This set of observations includes: (a) repeating, pulsed, increases in the temperature of the liquid; (b) increases in the pressure, and decreases in the liquid volume, showing that vaporization occurred at rates unexplainable by the conditions and energy inputs; (c) changes in shape and evidence of liquid mobility in palladium observable at the microscopic level in specific parts of the apparatus.

(a) Repeating, pulsed, increases in the temperature of the liquid.

Remember that the liquid had been raised to and then kept at a stable, that is, unchanging temperature for two hours in our early experiments; the amount of energy provided through the warming coil thus balancing the conductive/evaporative/radiative heat losses entirely. Without additional heat from the warming coil, repeated increases in the temperature of the liquid were observed – temperature spikes of more than 1° C lasting for more than 2 minutes. The temperature of the vessel's walls also changed, indicating that something was unbalancing the previously-stable input/heat loss state which had been maintained for two hours.

These temperature transients were observable whether the amount of liquid was 25 or 30 ml, and to a lesser extent whether the liquid was normal or heavy water. In several of the experimental runs, which were performed in a closed and sealed-off container (to protect against steam explosion hazards), post-experimental observations noted that some portion of the liquid had 'boiled off' during the experiment. It is entirely possible that the spike in temperature included a flash-over into steam of some portion of the liquid, and that the subsequent drop in temperature in part records the lifting of relief valve(s) and boil-off vaporization and cooling that would result.

In later runs, when the importance of silica/glass and non-contamination were more thoroughly recognized and adhered to, more consistent, almost regular patterns of thermal bursts were obtained. In the experiment run on January 19, 2009 the bursts of heat showed a periodicity of approximately 10-12 minutes. See Exhibit 3. Another

example of more regular periodicity is from the run of January 30, 2009, where the bursts of heat occur about every eight minutes, shown in Exhibit 4. The January 30 experiment included glass beads strung on the cathode. These two experiments and numerous others show that the exothermic heat is repeatable.

Further evidence of intense heat blooms are presented by the transformation in the materials of the apparatus, post-experiment. Sections of the wire used to provide the input electrodes were examined prior to the experiment; and, in several of the experiments, sections of the actual input electrodes were examined, by a Scanning Electron Microscope; and dramatic changes in the material of the electrode were observed in the latter that were never present in any of the former. An example of apparent spalling of palladium from the wire on the run of January 30, 2009 to the surface of a glass bead is Exhibit 5; this was observed on February 23, 2009. As with Exhibit 1, these are indications that the electrode attained 1,555°C and incandescence. (The SEM photo is mislabeled “013109”.)

*Unexpected, Non-predicted, Positive Effect Discovered and Confirmed*

Since the experiments are presumed to be affecting the liquid through input energies and stimuli transmitted through neutral means, the nature of the vessel containing the liquid has been presumed to be unimportant. The sole functionality, and the sole effect, of the containing vessel was presumed to be as a container. This assumption, made for simplification's sake (reducing the number of variables to be controlled), has been shown to be wrong.

Having the reaction contained within glass proved to be a critical issue. Attempts to run the protocol within materials such as stainless steel and Teflon were not successful. When conducted in such a glass vessel, the use of a DC stimulus in the protocol proved to be optional.

As the experiments progressed, the inventors observed the following:

- The chosen surfactant was a soluble form of silica.



- When the inner surface of the reaction vessel was lined with a glass beaker, the reaction improved. Glass is a form of silica.
- When the stainless-steel thermocouple wells were replaced with glass ones, the reaction improved.
- When a quartz cap was placed over the beaker, the reaction improved. Quartz is another form of silica.

Furthermore, the first step in the protocol described U. S. Patent 7,442,287 consisted of heating the solution until the bubbles had cleared from its surface. Those bubbles, of course, were characteristic of surfactants, and anionic silica hydride had originally been chosen for its surfactant properties. However, the disappearance of the bubbles indicated that the surfactant properties had also diminished or disappeared. What was left was the silica, plus the additives added by its maker, Patrick Flanagan.

By this time, the inventors had questioned the assumption as to the non-causality of the reaction vessel's surface quality, and predicted that silica could be an important part of the protocol.

Finally, we noted that our experiments required two hours or more before we began to observe bursts of heat and wondered what was happening during that time. We suspected that something must be happening to either the solution or to the electrodes in that period that was necessary to facilitate the observed reaction. Again, we noted a key fact: to the best of our knowledge, all of the successful LENR experiments conducted by either us or other experimenters have included lithium in the reaction. Lithium appears to be an essential ingredient. Reasoning that both silica and lithium are needed in the reaction and that the reaction does not occur immediately, we concluded that the silica and the lithium in our protocol are bonding in some way before the reaction occurs. Silicon is a very reactive atom, much like its smaller sibling in the periodic table, carbon. It combines with a great many other elements in a broad family of molecules. We believe that the lithium is combining with the anionic silica hydride in the solution to form a lithium silicate, generally expressed as  $\text{Li}_l\text{Si}_m\text{O}_n$ , probably either  $\text{LiSi}_4\text{O}_7$  or  $\text{LiSi}_3\text{O}_8$ .

With an absence of Deuterium-enriched source water, the lack of D-D fusion products, as suggested by the OA ¶14.g, should not be considered probative of a non-effect; particularly as the analysis methodologies used would not only not differentiate between elements with less than five protons (hydrogen, helium, lithium, and beryllium) but were not used to evaluate isotopic ratios. Nor could a small-scale, non-energy-lab operation afford either such costly tests or those needed to detect neutron bursts. The absence of such evidence from these experimental runs reflects the low-budget experimental technologies affordable and available, rather than the presence or absence of any results.

I declare under penalty of perjury under the laws of the U.S. and the State of California, that the foregoing is true and correct.

Executed on

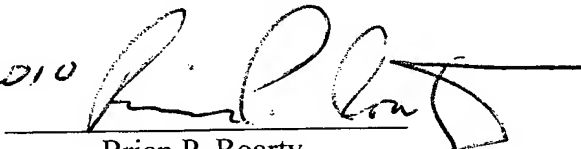
January 17, 2010   
Brian P. Roarty



Figure 1.g

*Exhibit 1*

# Atomic Concentration Table

Exhibit 2

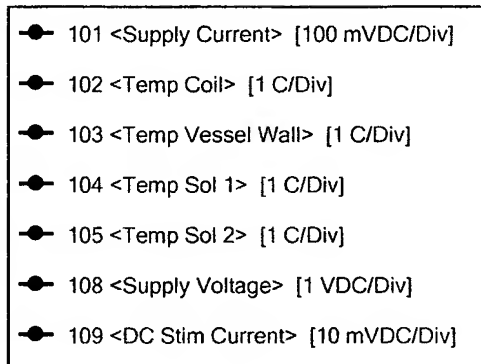
Description	Figure #	Carbon	Nitrogen	Oxygen	Magnesium	Aluminum	Silicon	Sulfur	Chlorine	Calcium	Copper	Zinc	Palladium
Sample C 12/28/08	3	Area #1	42	1	14	--	7	3	<1	--	4	1	27
	4	Area #2	36	2	23	--	11	3	<1	--	3	1	23
	5	Particle	19	--	50	9	21	1	--	--	--	--	--
	6	Coating	62	--	22	5	7	--	--	4	--	--	--
	7	Residue	49	--	34	3	10	--	--	--	--	--	--
Sample C 1/4/09	8	After Ion Etch	--	--	--	--	--	--	--	--	--	--	100
	9	Area #1	31	--	35	--	18	1	--	--	--	--	15
	10	Area #2	36	--	30	--	15	1	<1	--	--	--	18

EAG Job # C09W4614

Figure #11

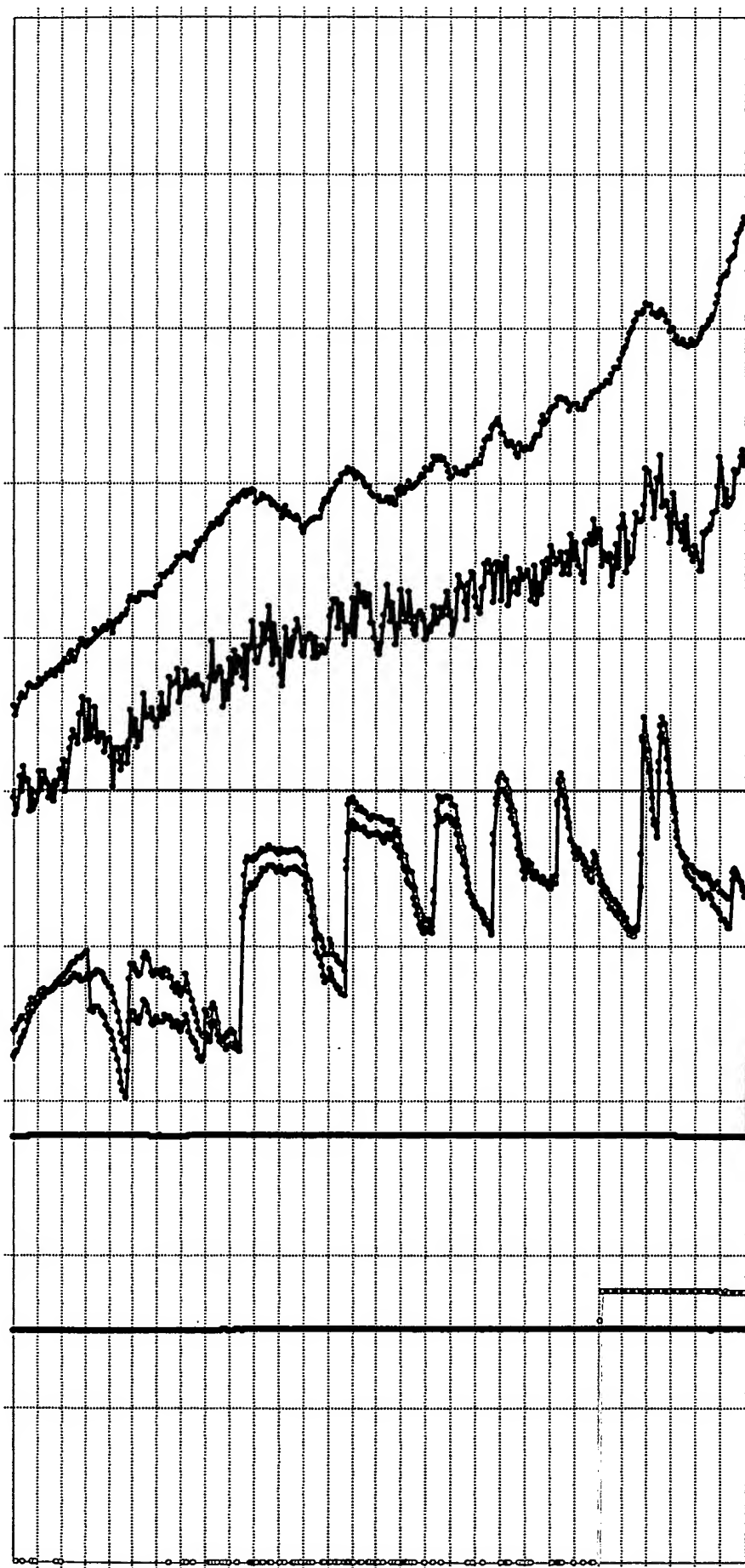


figure 2.6



## Palladium Electrodes and Heavy Water

Exhibit 3



- 101 <Supply Current> [100 mVDC/Div]
- 102 <Temp Coil> [1 C/Div]
- 103 <Temp Vessel Wall> [1 C/Div]
- 104 <Temp Sol 1> [1 C/Div]
- 105 <Temp Sol 2> [1 C/Div]
- 108 <Supply Voltage> [1 VDC/Div]
- 107 <DC Stim Voltage> [2 VDC/Div]

Figure 4.a

January 30, 2009

Palladium Electrodes,  
Glass Beads, and  
Heavy Water

*Exhibit 4*

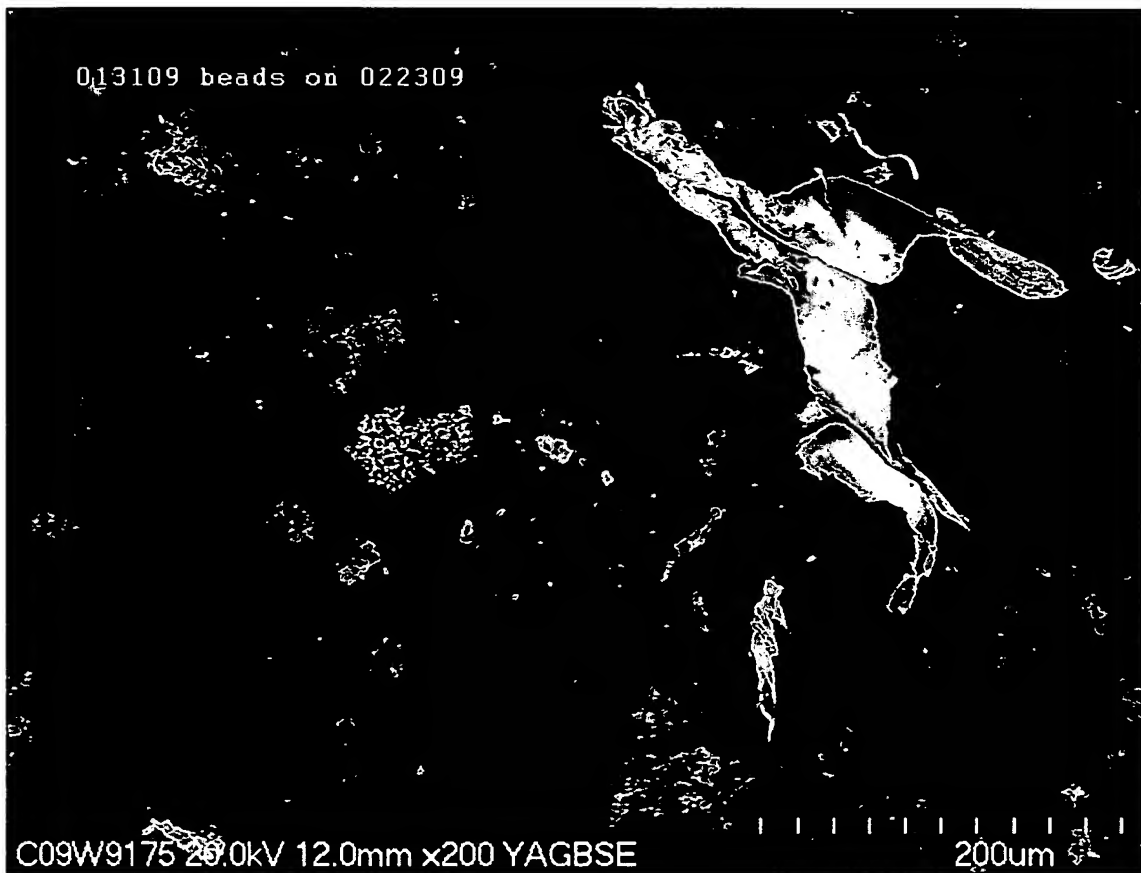


Figure 4.b

*Exhibit 5*